StudentID: PS/CSC/22/0090

Course Name: Computer Graphics

Technology Used: A-Frame (WebVR), HTML5, JavaScript, GLTF Models

Luxury Villa VR – Project Documentation

This document explains the design decisions, technical challenges encountered, and future improvements for the Luxury Villa VR project developed using A-Frame and WebVR technologies. The project represents a modern architectural villa experience with immersive interaction, 3D assets, environmental lighting, animated components, and a detailed exterior landscape.

1. Design Choices

Modern Architectural Concept: The villa was designed with a flat roof and parapet walls to reflect contemporary minimalist architecture.

• Spatial Layout: The interior was divided into living room, bedroom, kitchen, and washroom to simulate a realistic residential floor plan.

• Material Selection: Textures such as marble, stone, wood, and tiles were used to enhance realism and visual richness.

• Lighting Strategy: Ambient and directional lighting were implemented to simulate daylight conditions, while point lights were added for interior realism.

• Interactive Environment: Movement controls (WASD + mouse) were implemented to allow users to explore the space freely.

• Animated Elements: Ceiling fans and pool water animation were included to enhance immersion.

• Outdoor Features: A modern swimming pool, perimeter fencing, driveway, landscaping, and a luxury car were added to elevate the realism of the environment.

2. Technical Challenges and Solutions

• Asset Loading and Scaling: GLTF models required careful scaling and positioning to align correctly within the 3D scene. This was resolved through trial adjustments of position and scale attributes.

• Performance Optimization: Large textures and multiple 3D models increased load time. Optimization was achieved by using low-poly models and limiting excessive lighting.

• Lighting Balance: Achieving realistic lighting without overexposure required balancing ambient and directional light intensities.

• Collision and Navigation: Ensuring smooth movement inside the villa required proper positioning of interior walls and careful spatial planning.

• Pool Water Effect: Simulating water realism was challenging. Opacity, reflection, and animated surface properties were used to mimic water behavior.

3. Future Improvements

• Addition of interactive doors and smart light switches for enhanced realism.

• Implementation of night mode with dynamic lighting transitions.

• Integration of sound effects (ambient outdoor sounds, indoor background music).

• Enhanced water shader for more realistic pool reflections and wave simulation.

• Mobile optimization for smoother performance on lower-end devices

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• VR headset optimization for full immersive experience.